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FLOOD INSURANCE STUDY

ORIGINAL



COMPLETED

40

CITY OF
WAITSBURG,
WASHINGTON
WALLA WALLA COUNTY



MAY 3, 1982



Federal Emergency Management Agency

COMMUNITY NUMBER-530196

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Waitsburg, Walla Walla County, Washington, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study will be used to convert Waitsburg to the regular program of flood insurance by the Federal Emergency Management Agency. Local and regional planners will use this study in their efforts to promote sound flood plain management.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than those on which these federally supported studies are based. These criteria take precedence over the minimum Federal criteria for purposes of regulating development in the flood plain, as set forth in the Code of Federal Regulations at 24 CFR, 1910.1(d). In such cases, however, it shall be understood that the State (or other jurisdictional agency) shall be able to explain these requirements and criteria.

1.2 Authority and Acknowledgments

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers, Walla Walla District, for the Federal Emergency Management Agency, under Inter-Agency Agreement No. IAA-H-10-77, Project Order No. 20. This work, which was completed in July 1981, covered all significant flooding sources affecting the City of Waitsburg.

1.3 Coordination

Streams requiring detailed study were identified at a meeting attended by representatives of the study contractor, the Federal Emergency Management Agency, and the city in May 1976.

An intermediate coordination meeting was held in Waitsburg on July 7, 1981, and was attended by representatives of the Federal Emergency Management Agency, the city, and the study contractor.

The final coordination meeting was held in Waitsburg on December 2, 1981, and was attended by representatives of the Federal Emergency Management Agency, the city, and the study contractor. No changes were proposed at this time.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated areas of the City of Waitsburg, Walla Walla County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Touche' River and Coppei Creek were studied by detailed methods within the corporate limits.

Those areas studied by detailed methods were chosen with consideration given to all proposed construction and forecasted development through 1986.

2.2 Community Description

The City of Waitsburg is located in eastern Walla Walla County, in southeastern Washington. The population of Waitsburg in 1980 was 1035 (Reference 1).

The economy of Waitsburg is dependent on agriculture; dryland farming in the uplands with irrigated lands in the valleys of Coppei Creek and Touchet River.

The South and East Forks of Touchet River originate near the southern and eastern borders of the county on slopes of the Blue Mountains at elevations between 4000 and 5800 feet. Touchet River flows westerly through Waitsburg, which lies at an elevation of approximately 1,250 feet. Upper part of the drainage area are steep, rough, forested mountain slopes. Streams flow in deep canyons. Foothill slopes and rolling lands are situated in the middle elevations of the area. Coppei Creek flows northwesterly through the southwestern corner of the city. Waitsburg lies in a fairly flat valley, the floor of which consists of alluvial materials, cobbles, and gravels overlain by fertile, but shallow, sandy and silty loams (Reference 2).

The climate of the area is generally temperate, with wide temperature variations. The mean annual temperature is approximately 51°F, with January and July averages of 32°F and 71°F, respectively. Extreme temperatures of 109°F and -32°F have been recorded. Average annual precipitation ranges from 19 inches to more than 50 inches in the mountains (Reference 2).

2.3 Principal Flood Problems

Touchet River usually has high flows in the spring from snowmelt and low flows in the summer and fall. However, major floods have occurred in the winter from general rainstorms, which cause a high percentage of runoff.

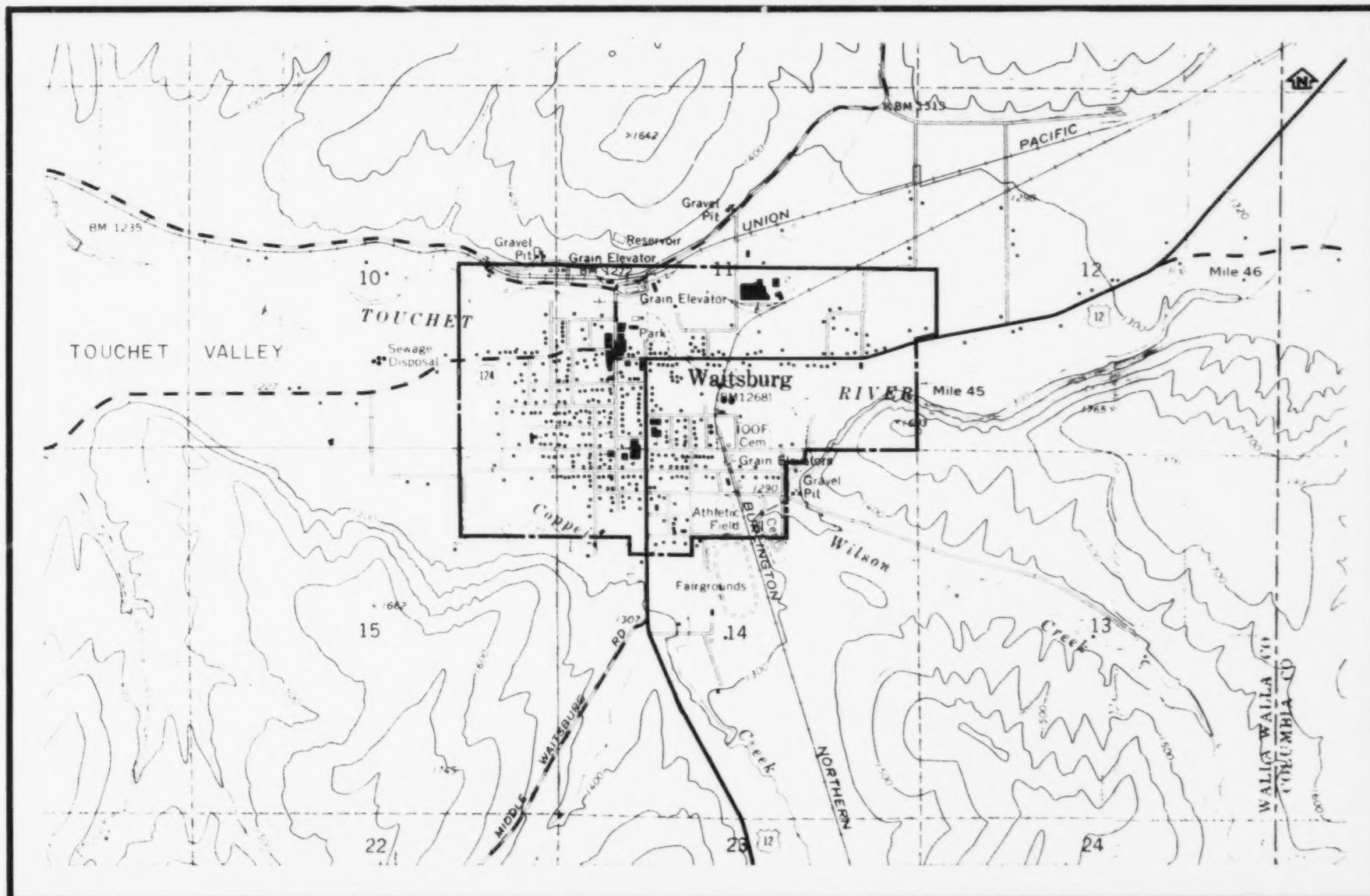


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

APPROXIMATE SCALE

2000 0 2000 4000 6000 FEET

VICINITY MAP

Recorded floods of significant size occurred in 1906, 1931, 1949, 1964, and 1972 on Touchet River. The maximum flood on Touchet River at Waitsburg occurred in December 1964, with a peak discharge of 9350 cubic feet per second (cfs) and a recurrence interval slightly less than 100 years. Coppei Creek has had several floods of significant size, but the floods were never gaged.

2.4 Flood Protection Measures

Flood damage prevention measures within Waitsburg are limited to those constructed by local interests or by Federal agencies under emergency conditions. They consist of channel clearing and emergency levee construction and are not considered permanent nor adequate to protect against a 100-year event.

The National Weather Service provides flash flood forecasts and warnings under its Flash Flood Alert, Watch and Warning Program. The City of Waitsburg, in cooperation with the National Weather Service and Defense Civil Preparedness Agency, has established a Flash Flood Alarm System and Warning Plan.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equalled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equalled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual occurrence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported here reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail affecting the community.

A U.S. Geological Survey gaging station on Touchet River near Bolles, located approximately 3 miles downstream from Waitsburg, was the principal source of data for defining discharge-frequency relationships for the river. The gage has been in operation since 1951. Values of the 10-, 50-, 100-, and 500-year peak discharges were obtained from a log-Pearson Type III distribution of annual peak flow data. Coppei Creek has never been gaged for streamflow.

To define discharge-frequency data for Touchet River and Coppei Creek, two methods of analysis were used. A regional relationship of basin characteristics to streamflow characteristics was the principal method used (Reference 3). The other method used was the regional relationship of peak discharge to drainage area for nearby gaging stations having similar hydrologic settings (Reference 3).

Peak discharge-drainage area relationships for Touchet River and Coppei Creek are shown in Table 1.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in the community were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

Water-surface elevations of floods of the selected recurrence intervals were computed through use of the U.S. Army Corps of Engineers HEC-2 step-backwater computer program (Reference 4).

Cross section data for the backwater analyses of Touchet River and Coppei Creek were obtained by ground surveys.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Hydraulic roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgment and based on field observations of the streams and flood plain areas. The roughness value for the main channel of Touchet River was estimated to be 0.040; overbank roughness values ranged from 0.035 to 0.045. The roughness value for the main channel of Coppei Creek was estimated to be 0.040; overbank roughness values ranged from 0.035 to 0.045.

Starting water-surface elevations for Touchet River were calculated using the normal depth method.

Table 1. Summary of Discharges

<u>Flooding Source and Location</u>	<u>Drainage Area (Square Miles)</u>	<u>Peak Discharges (Cubic Feet per Second)</u>			
		<u>10-Year</u>	<u>50-Year</u>	<u>100-Year</u>	<u>500-Year</u>
Touchet River					
Below Confluence With Coppei Creek (at Bolles)	372	6,000	9,900	12,000	18,000
Above Confluence With Coppei Creek	321	5,400	8,900	10,860	16,000
Coppei Creek					
At Waitsburg	37	760	1,520	2,000	3,650

Starting water-surface elevations for Coppei Creek were taken at its confluence with Touchet River.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals (Exhibit 1).

Flow from Coppei Creek breaks out at the U.S. Highway 12 bridge and flows northwesterly through the city. Depths of floodwater in shallow flooding areas were determined by field observation and engineering judgment to be between 6 inches and 2 feet, with an average depth of 1 foot.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in the study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the Federal Emergency Management Agency as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were developed photogrammetrically, using aerial photographs at a scale of 1:6000 (Reference 5).

Flood boundaries for the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations and, therefore, not be subject to flooding; owing to limitations of the map scale, such areas are not shown.

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood may be carried without substantial increases in flood heights. Minimum standards of the Federal Emergency Management Agency limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Touchet River								
A	90	445 ²	1,545	7.0	1,237.9	1,237.9	1,238.6	0.7
B	1,870	590	1,592	6.8	1,246.5	1,246.5	1,247.2	0.7
C	2,710	270	1,023	10.6	1,251.4	1,251.4	1,251.4	0.0
D	2,890	251	1,733	6.3	1,256.7	1,256.7	1,256.7	0.0
E	3,260	562	4,435	2.4	1,257.3	1,257.3	1,257.3	0.0
F	3,710	550	2,761	3.9	1,257.4	1,257.4	1,257.4	0.0
G	4,190	501	2,095	5.2	1,257.6	1,257.6	1,257.8	0.2
H	4,620	550	1,706	6.4	1,259.1	1,259.1	1,259.2	0.1
I	4,840	318	1,142	9.5	1,260.5	1,260.5	1,260.7	0.2
J	4,990	322	1,652	6.6	1,262.2	1,262.2	1,262.3	0.1
K	6,005	275	1,181	9.2	1,266.1	1,266.1	1,266.4	0.3
L	7,175	272	1,400	7.8	1,274.2	1,274.2	1,274.4	0.2
M	7,940	209	1,400	7.8	1,277.9	1,277.9	1,278.7	0.8

¹Feet Above Limit of Flooding Affecting Waitsburg

²Floodway Lies Entirely Outside Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

FLOODWAY DATA

TOUCHET RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Coppei Creek								
A	4,460	42 ²	322	6.2	1,241.0	1,241.0	1,241.0	0.0
B	5,010	36	248	8.1	1,242.5	1,242.5	1,242.5	0.0
C	5,860	38	202	9.9	1,248.0	1,248.0	1,248.0	0.0
D	8,285	86	302	6.6	1,261.5	1,261.5	1,261.7	0.2
E	10,180	110/10 ³	347	5.8	1,276.2	1,276.2	1,276.2	0.0
F	10,340	149/100 ³	335	6.0	1,280.1	1,280.1	1,280.1	0.0

¹Feet Above Mouth ²Floodway Lies Entirely Outside Corporate Limits ³Width/Width Within Corporate Limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

FLOODWAY DATA

COPPEI CREEK

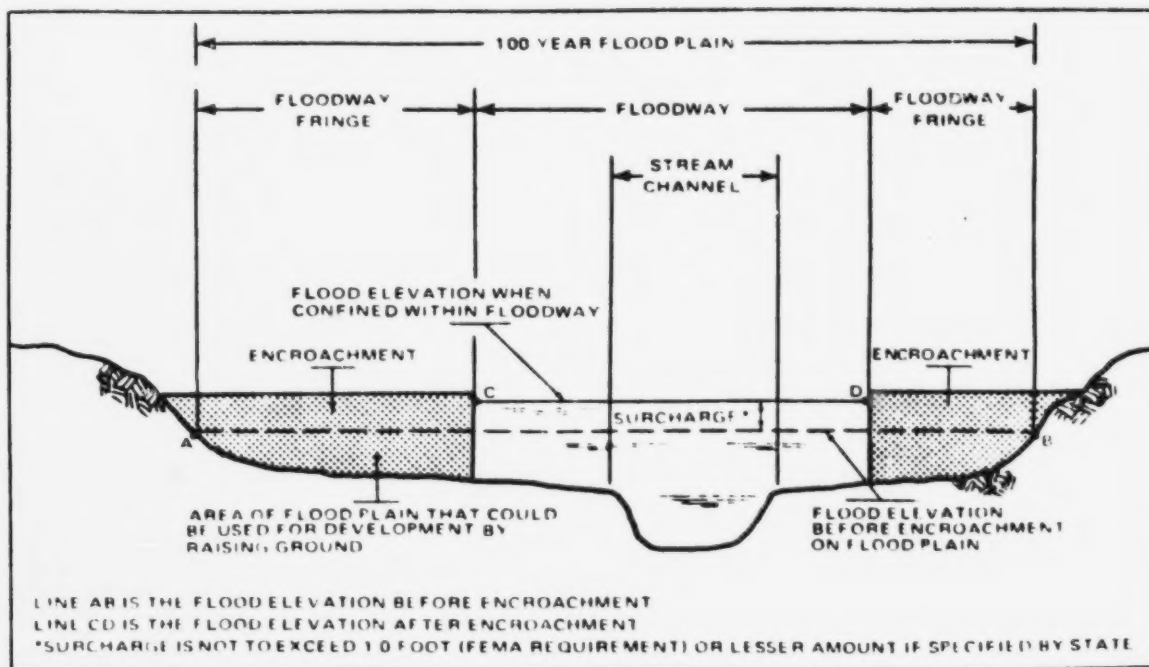


Figure 2. Floodway Schematic

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the Federal Emergency Management Agency has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHF's), and flood insurance zone designations for each flooding source studied in detail affecting the City of Waitsburg.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of Waitsburg are shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The FHF is the Federal Emergency Management Agency device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHF are used to set actuarial insurance premium rate tables based on FHF's from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest one-half foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHF's, the entire incorporated area of Waitsburg was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

- | | |
|-----------------------|--|
| Zone A0: | Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; depths are shown, but no FHF's are determined. |
| Zones A3, A4, and A6: | Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF's. |
| Zone B: | Areas between the Special Flood Hazard Areas and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with |

BEST DOCUMENT AVAILABLE

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Touchet River							
Reach 1	0001	-1.5	-0.4	0.9	015	A3	Varies - See Map
Reach 2	0001	-2.2	-0.8	2.0	020	A4	Varies - See Map
Coppei Creek							
Reach 1	0001	-3.0	-0.9	1.6	030	A6	Varies - See Map
Shallow Flooding	0001	N/A	N/A	N/A	N/A	A0	Depth - 1 foot

¹ Flood Insurance Rate Map Panel

² Weighted Average

³ Rounded to Nearest Foot

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

FLOOD INSURANCE ZONE DATA

TOUCHET RIVER-COPPEI CREEK

drainage areas less than 1 square mile.
Zone B is not subdivided.

Zone C: Areas of minimal flooding.

The flood elevation differences, FHF's, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Waitsburg is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the Federal Emergency Management Agency.

6.0 OTHER STUDIES

A Special Flood Hazard Information report on Coppei Creek and Touchet River for Waitsburg was published in 1974 (Reference 2). A Flood Hazard Boundary Map for Waitsburg was published in 1976 (Reference 6). This Flood Insurance Study supersedes both of these studies.

A Flood Insurance Study is being prepared for the unincorporated areas of Walla Walla County (Reference 7); the results of the county study are in agreement with this study.

This study is authoritative for the purposes of the National Flood Insurance Program; data presented herein either supersede or are compatible with all previous determinations.

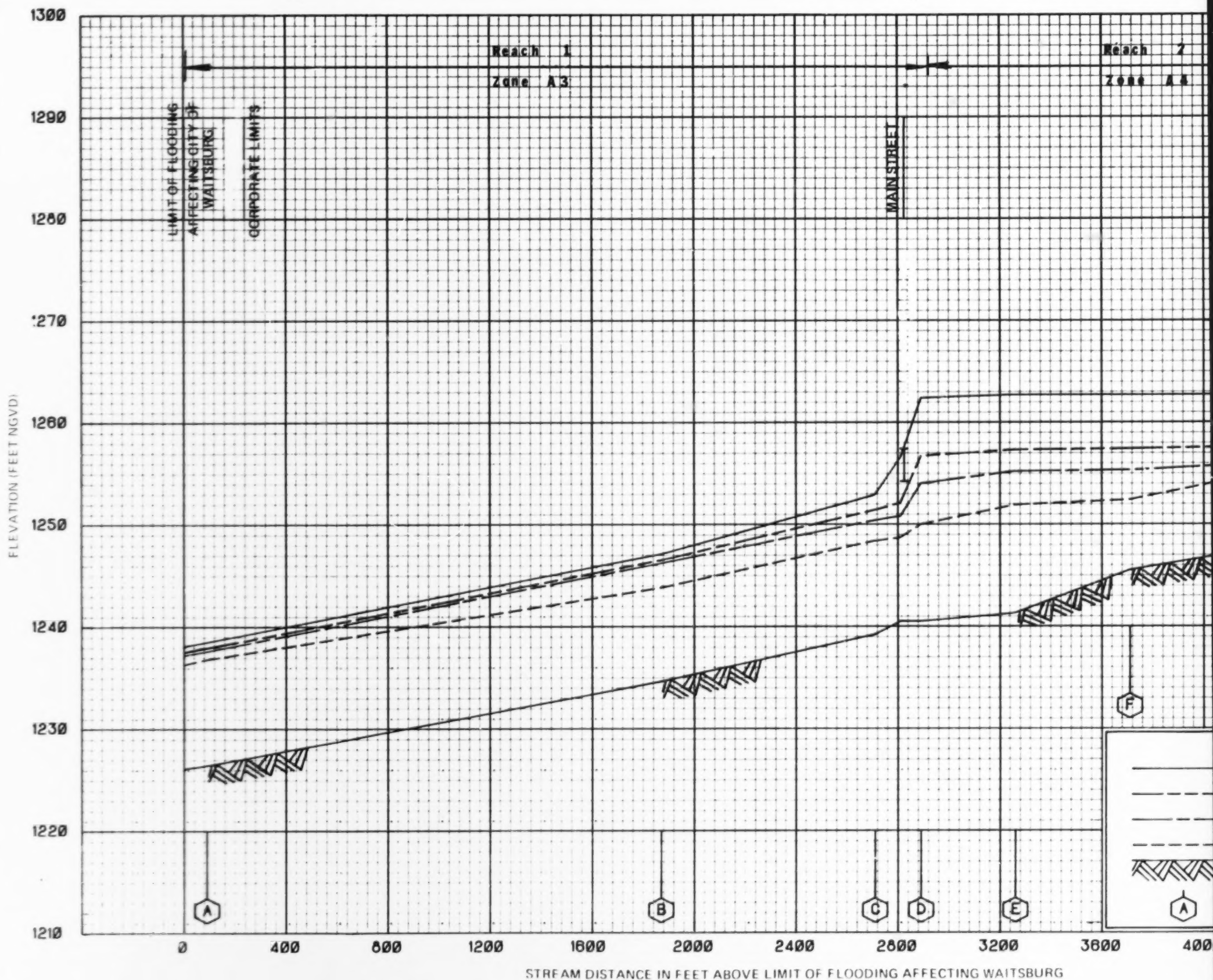
7.0 LOCATION OF DATA

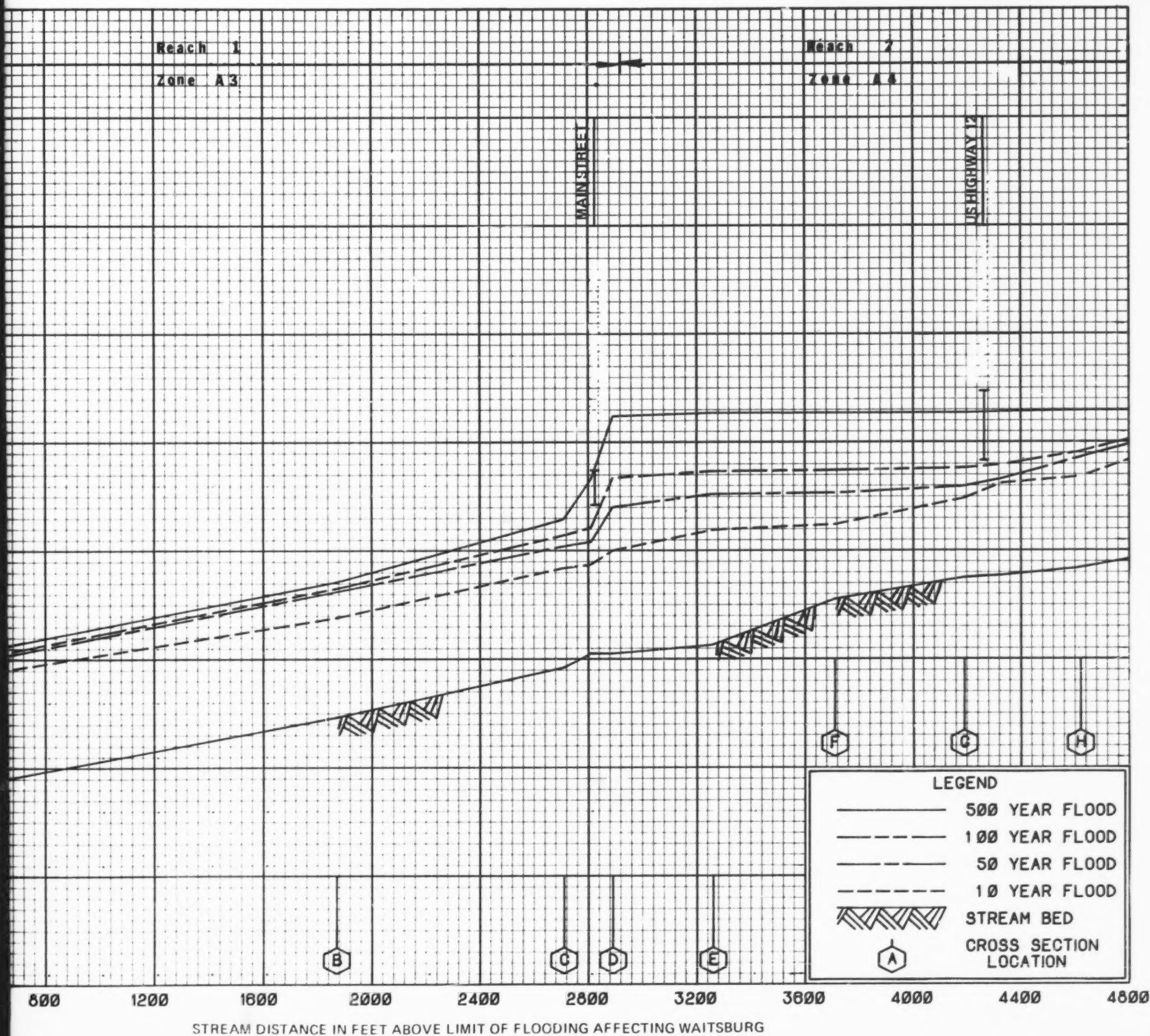
Survey, hydrologic, hydraulic, and other pertinent data used in this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Federal Regional Center, 130 228th Street, NW., Bothell, Washington 98011.

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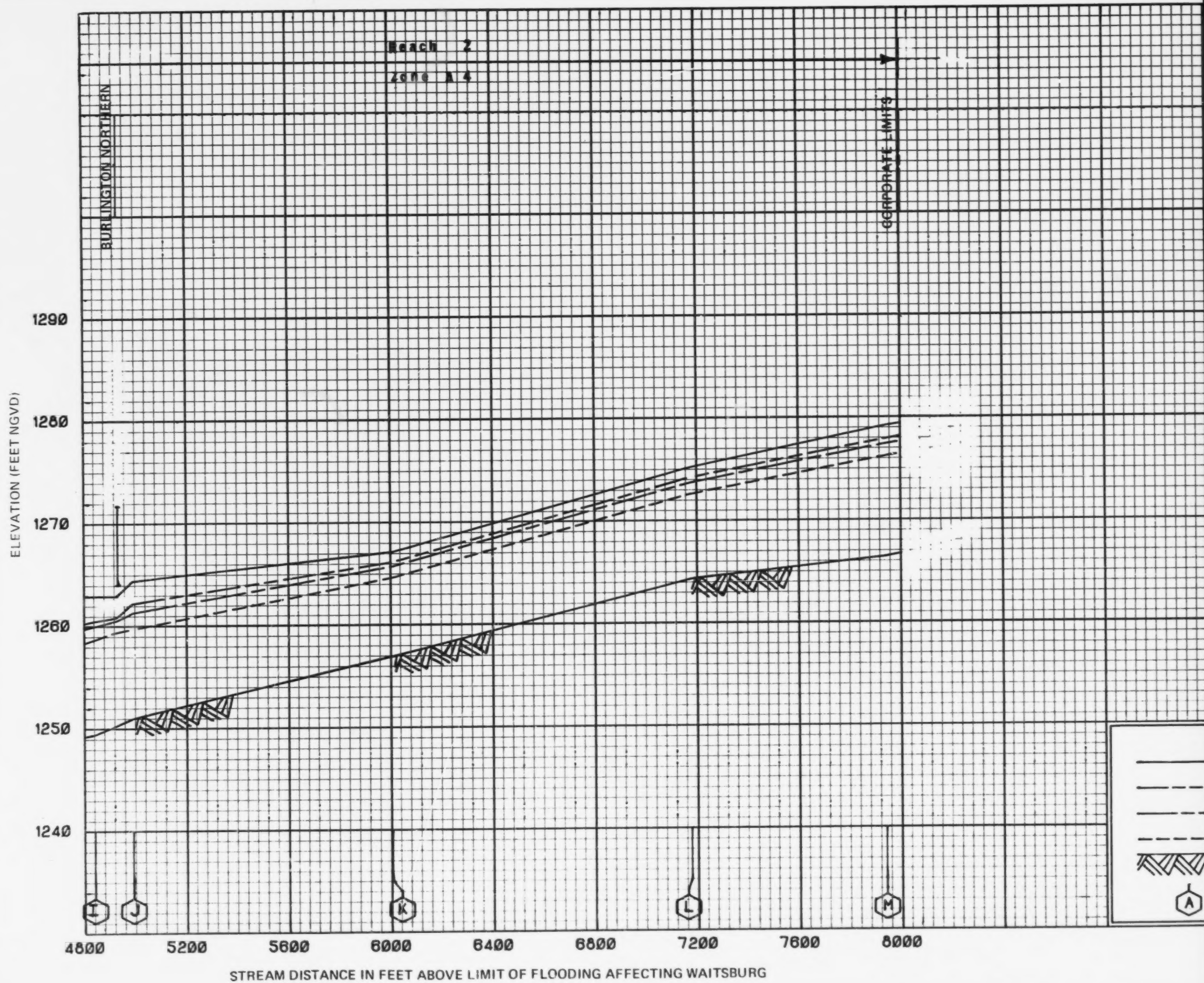


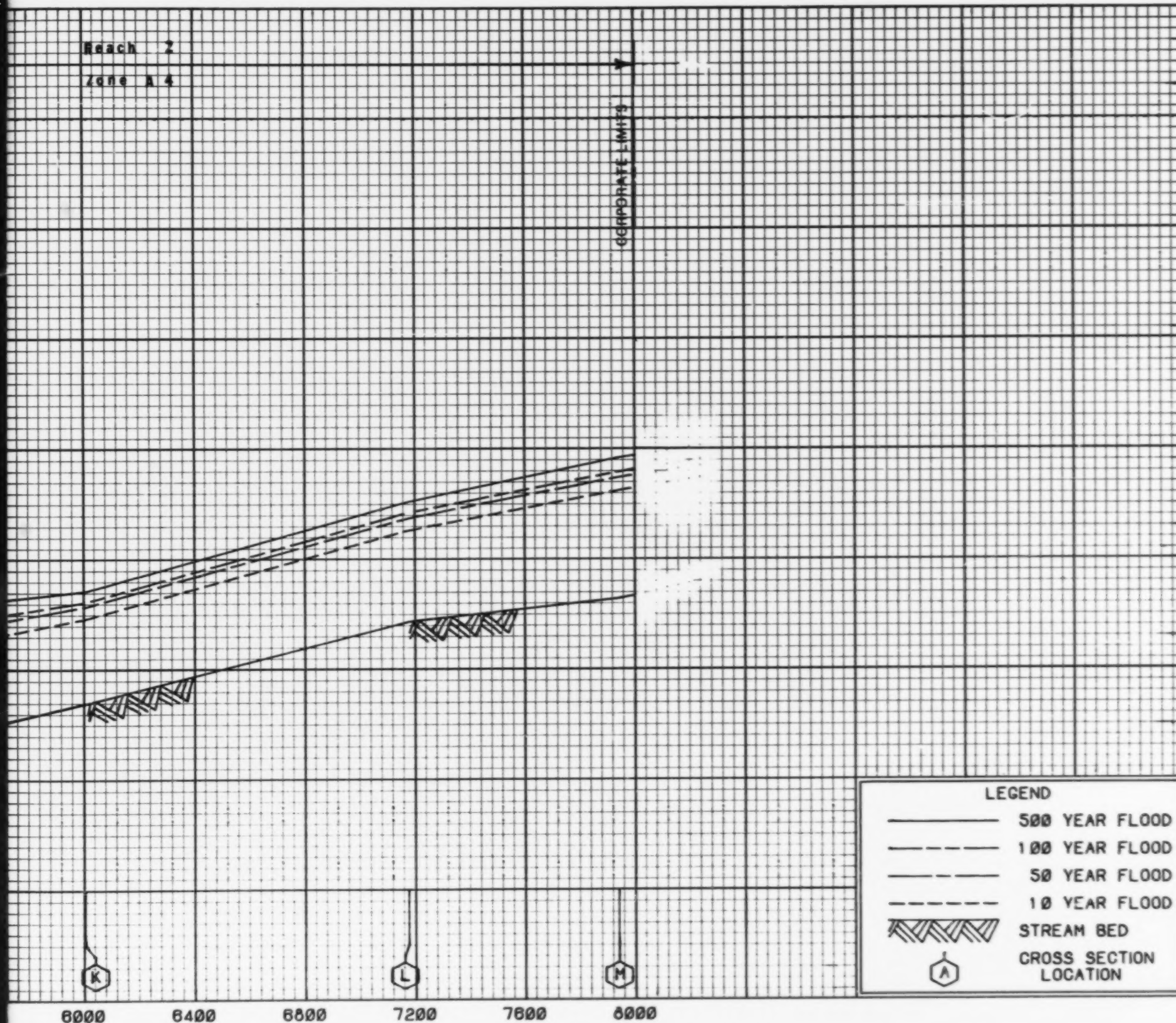
FLOOD PROFILES
TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF WAITSBURG, WA
(WALLA WALLA COUNTY)

01P

16-A





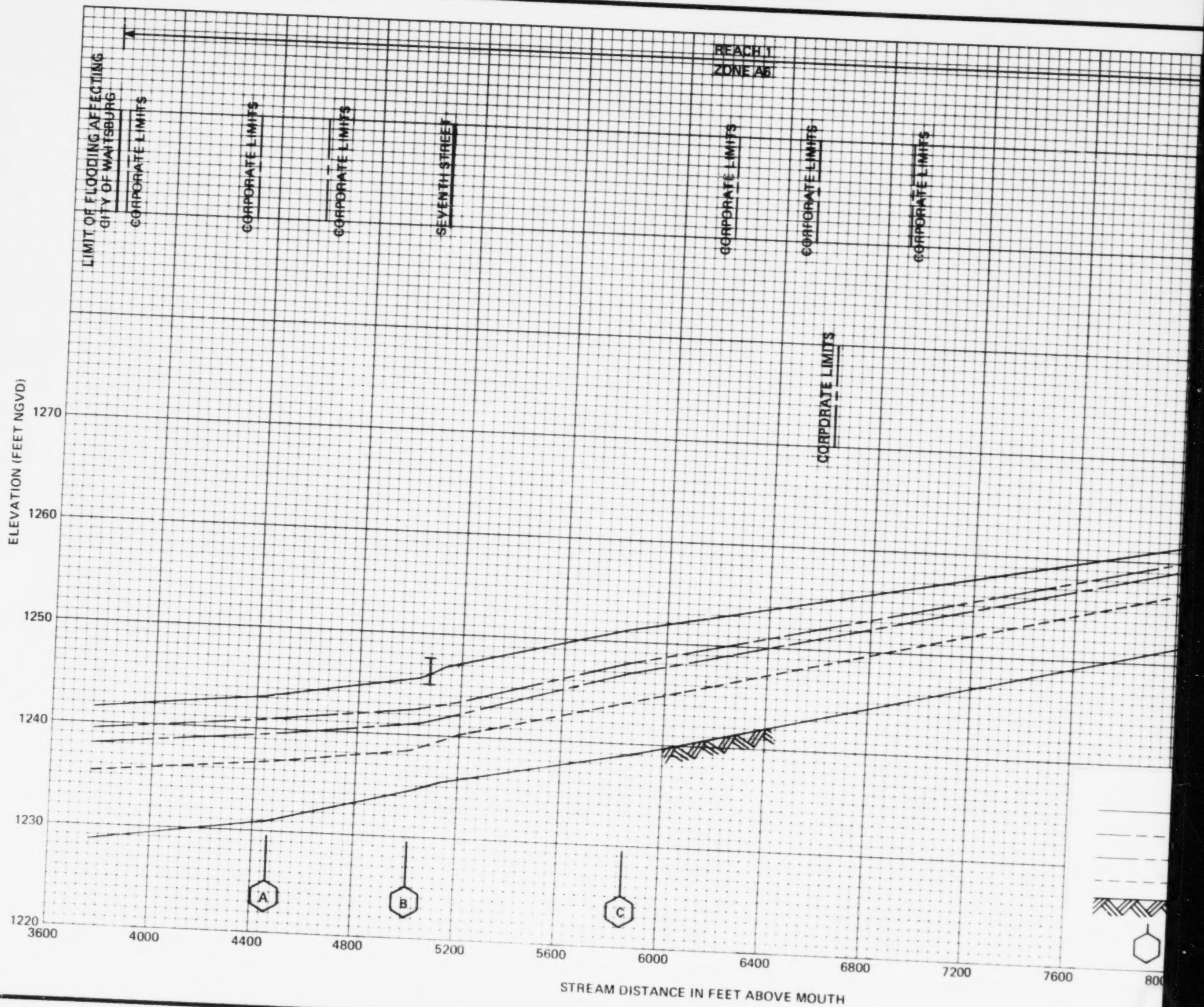
ANCE IN FEET ABOVE LIMIT OF FLOODING AFFECTING WAITSBURG

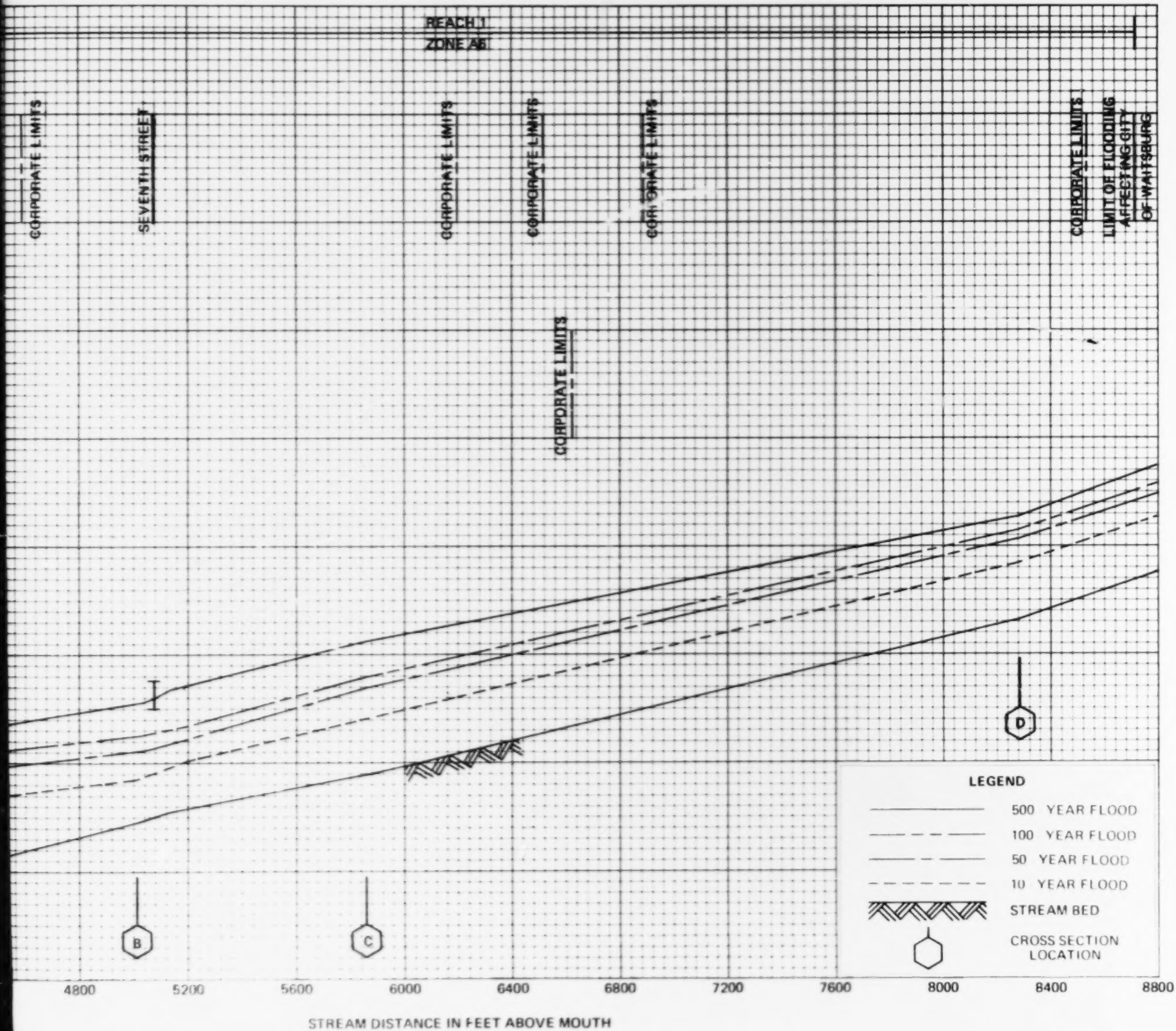
FLOOD PROFILES
TOUCHET RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF WAITSBURG, WA
(WALLA WALLA COUNTY)

02P

17-A





FLOOD PROFILES

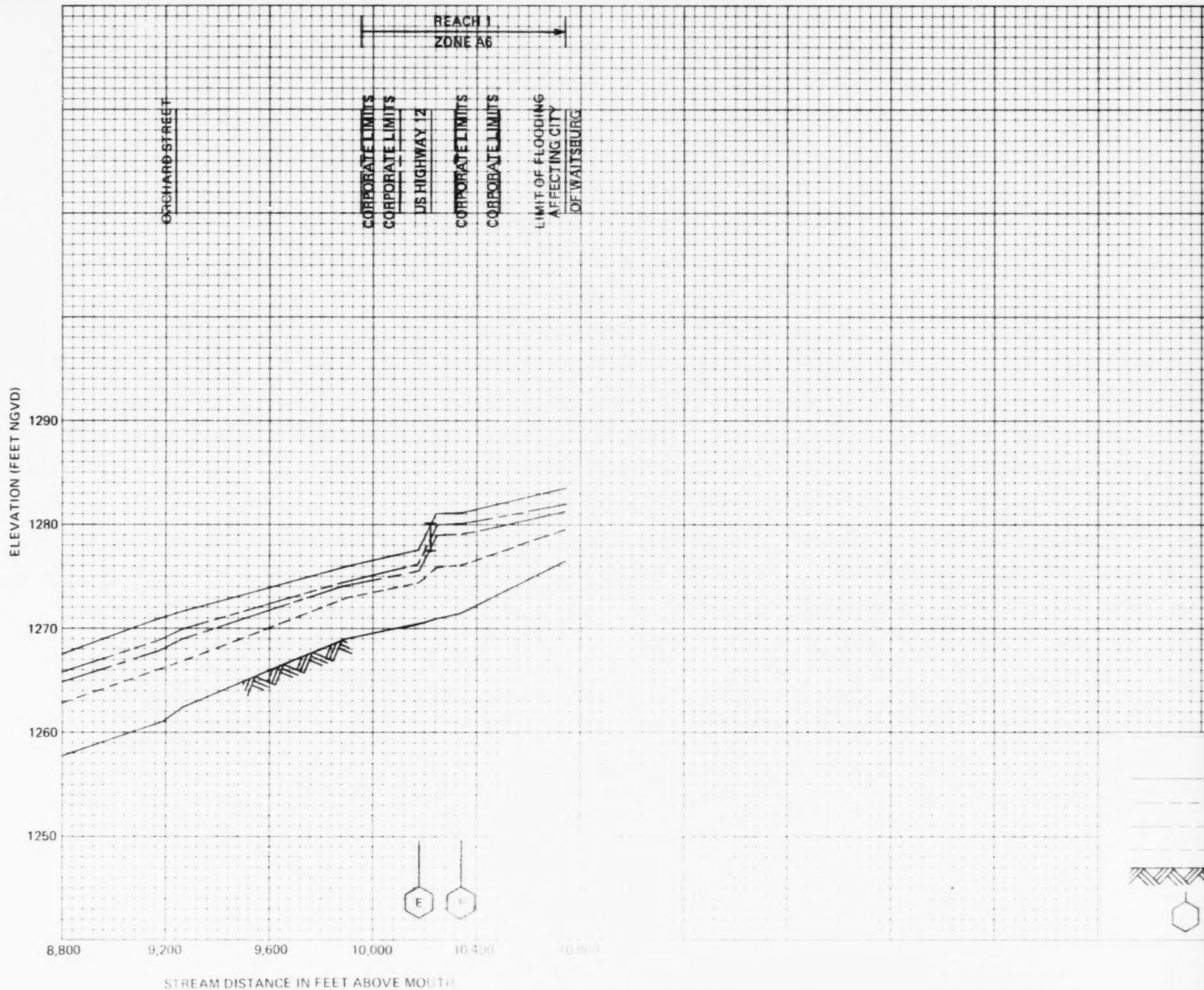
COPPEI CREEK

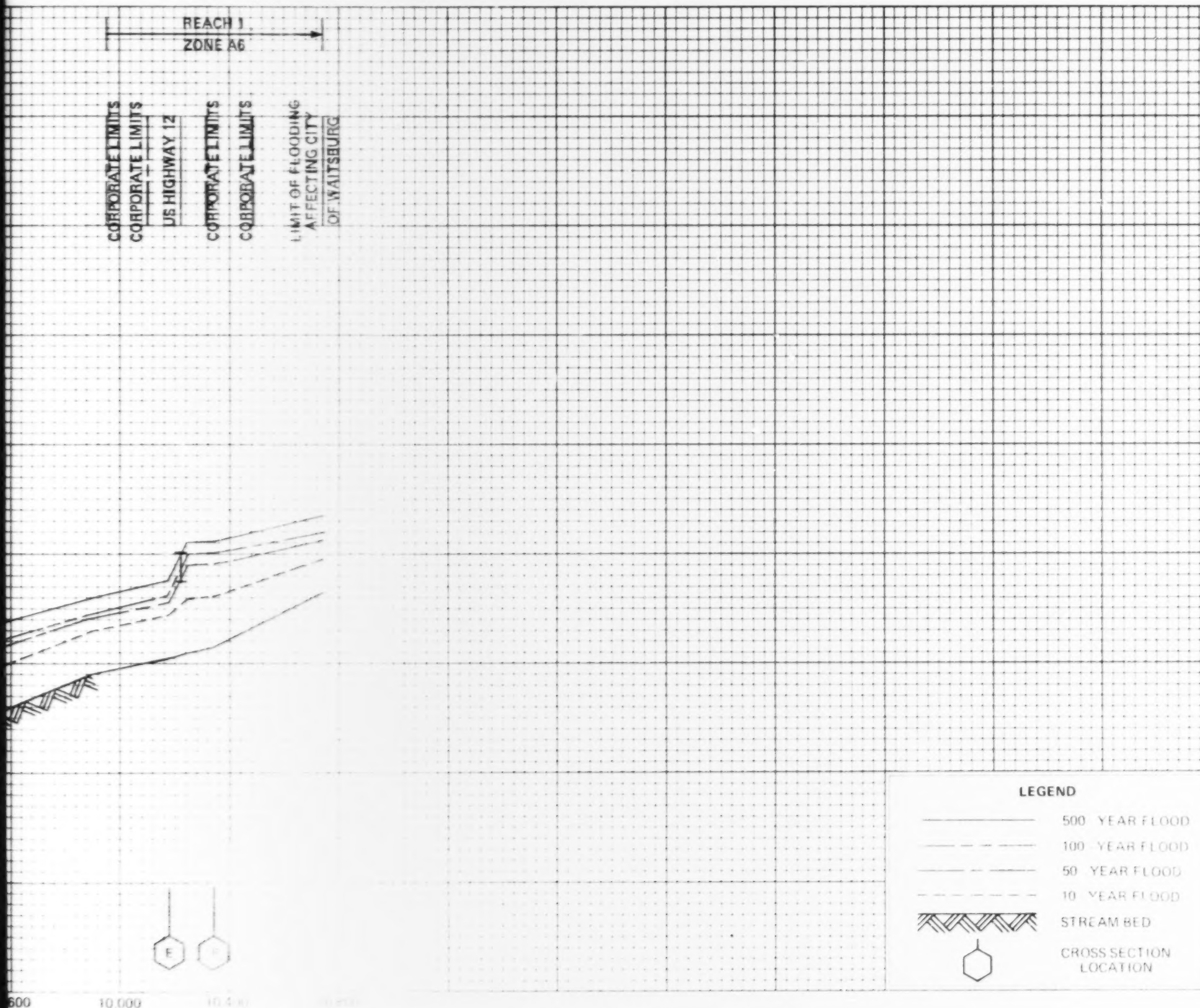
FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

03P

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FLOOD PROFILES

COPPEI CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WAITSBURG, WA
(WALLA WALLA CO.)

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